

Learning Environment & Situational Factors to Consider

The Cell, Unit for DP/AP Biology G11

1. Specific Context of the Teaching/Learning Situation

How many students are in the class? Is the course primary, secondary, undergraduate, or graduate level? How long and frequent are the class meetings? How will the course be delivered: live, online, blended, flipped or in a classroom or lab? What physical elements of the learning environment will affect the class? What technology, networking and access issues will affect the class?

- Students: about 6, 3 class periods
- Secondary level, 11th grade AP/DP students
- A/B schedule, meet on A-days (2-3 each week)
- Delivery method: Lab classroom and blended (1:1 iPad-iTunes U course as delivery of content)
- Currently, our IT is working on network connectivity issues. In addition to our iPads, we have 15 Macbook Airs to support our use of flash websites or other uses.

2. General Context of the Learning Situation

What learning expectations are placed on this course or curriculum by: the school, district, university, college and/or department? the profession? society?

- A blend of AP/DP curriculum must be considered for this unit.
- Grading criteria experiments are based upon the Internal Assessment rubrics from International Baccalaureate (IB). Students do not complete this IA until their senior year, but we model this during the junior year to work on skills.

3. Nature of the Subject

Is this subject primarily theoretical, practical, or a combination? Is the subject primarily convergent or divergent? Are there important changes or controversies occurring within the field?

- Subject (The Cell) is practical.
- This topic is primarily convergent (structure/function of each cell organelle), but can be divergent with the application of knowledge (understanding the role of each organelle is dependent upon other cell organelles).
- There can be controversies in the theory of the origin of cells that offer theory of knowledge discussions.

4. Characteristics of the Learners

What is the life situation of the learners (e.g., socio-economic, cultural, personal, family, professional goals)? What prior knowledge, experiences, and initial feelings do students usually have about this subject? What are their learning goals and expectations?

- Our school is in an affluent area. Most students are Anglo-American.
- G11 students have already been exposed to cells in their freshmen year as a state requirement. This unit should serve as a bit of review for some aspects, but the opportunity for students to go deeper in their understanding of how cell organelles function specifically.
- Learning goals and expectations overview: The biological revolution (the origin of cells) is due to the interaction of cell organelles. Students should be able to explain the origin of cells and each organelle's structure and function in a prokaryotic and eukaryotic cell.

- Essential ideas: The evolution of multicellular organisms allowed cell specialization and cell replacement, Eukaryotes have a much more complex cell structure than prokaryotes, The structure of biological membranes makes them fluid and dynamic, Membranes control the composition of cells by active and passive transport.

5. Characteristics of the Teacher

What beliefs and values does the teacher have about teaching and learning? What is his/her attitude toward: the subject? students? What level of knowledge or familiarity does s/he have with this subject? What are his/her strengths in teaching?

- We have just come from a unit on biochemistry, which has been heavy on specific details. Students enjoy learning about the cell because they have learned about it in science their whole life. Now, we spend time clearing up misconceptions and focusing on how the organelles may operate together to make “life” happen.
- I like to teach in a constructivist/connectivist manner that allows for students to explore and play within the constraints I provide. Labs and activities are heavily used during this unit to further develop the understanding of cell organelles, beyond the lessons students will do outside of class (a bit blended or flipped classroom learning).
- My strengths are the guided constraints I provide and the labs we work with that allow students to come to a conclusion of understanding. These activities allow for students to use their strongest learning styles. I am very familiar with cells and have taught this topic for 5 years.

Questions for Formulating Significant Learning Goals

A year (or more) after this course is over, I want and hope that students [will recognize the impact that the function of cell organelles have on the function of complex organisms.](#)

My Big Harry Audacious Goal (BHAG) for the unit is:

[For students to thoroughly explain that all cell organelles are interconnected and depend upon each other in regulation, specialization, and transportation for the survival of the cell.](#)

[\(some units are more authentic in their learning, but for this unit I want to work on AP/DP testing skills, which will focus on command terms and analysis of data from experiments conducted\).](#)

Foundational Knowledge

- What key information (e.g., facts, terms, formulae, concepts, principles, relationships, etc.) is/are important for students to understand and remember in the future?
 - [AP and DP Standards are linked here](#)
- What key ideas (or perspectives) are important for students to understand in this course?
 - [Terminology is very unique to this unit.](#)
 - [Cell organelles do not operate independently; they work together to maintain homeostasis of a cell, and ultimately of an organism.](#)

- The origin of cells seem complex and controversial, but when based upon the understanding of cell organelles, is simple and supported by evidence.

Application Goals

- What kinds of thinking are important for students to learn?
 - Critical thinking, in which students analyze and evaluate
 - *Students will be required to interpret and analyze data, evaluate experimentation, draw conclusions, and use models and simulations to explore complex systems.*
 - Creative thinking, in which students imagine and create
 - *Students will need to use their skills to draw cells, the cell organelles, and a detailed cell membrane.*
 - *Applying their knowledge, students will create a video to explain how a cell membrane functions.*
 - Practical thinking, in which students solve problems and make decisions
 - *Students will need to apply knowledge of cell transport to osmosis and diffusion problems.*
- What important skills do students need to gain?
 - *Students should walk away with analyzing and evaluative skills, as well as deductive reasoning of cell transport.*
- Do students need to learn how to manage complex projects?
 - *Students will need to manage the analysis of the cell transport lab.*

Integration Goals

- What connections (similarities and interactions) should students recognize and make...:
 - Among ideas *within* this course?
 - *Students should see that the function of cell organelles drives life and often are dependent upon each other. In addition, their understanding of these organelles should lend to the understanding complex eukaryotic cells are due to the symbiotic relationship of original organelles at the “origin of cells,” (biological revolution.*
 - Among the information, ideas, and perspectives in this course and those in other courses or areas?
 - *Students may see there is a clear relationship between the cell organelles and complex systems of organisms we will discuss in future units.*
 - Among material in this course and the students' own personal, social, and/or work life?
 - *Students may see a correlation to diseases or common health related issues that exist when cell organelles are not working properly.*

Human Dimensions Goals

- What could or should students learn about themselves?
 - *Students will learn that the basic functions of breathing, eating, exercising, excretions of waste, etc are due to the requirements and functions of cells and cell organelles. The actions we take for granted are really due to the “small” interactions that happen 24/7 inside of our cells.*
- What could or should students learn about understanding others and/or interacting with them?
 - *Students will learn to respect others’ opinions as we discuss the biological revolution and learn to have an appreciation for the historical development of the current understanding of the origin of cells.*

Caring Goals

- What changes/values do you hope students will adopt?
 - Interests: I hope students gain an interest in other body systems, as they are dependent upon the functioning of cells.
 - Values: I hope students find value in exploring and understanding things we cannot see.

"Learning-How-to-Learn" Goals

- What would you like for students to learn about:
 - How to become a self-directed learner of this subject, i.e., having a learning agenda of what they need/want to learn, and a *plan* for learning it?
 - I have been teaching students to come to class prepared for the lesson. Most of the homework I assign is “flipped” lessons so that the discussion and critical thinking can happen together as we “wrestle” with concepts together through activities. I want them to learn to be intrinsically motivated to learn in-depth on a concept they may feel they know a lot about.

BHAG (Big Hairy Audacious Goal) – Overarching Course Goal

Explain that all cell organelles are interconnected and depend upon each other in regulation, specialization, and transportation for the survival of the cell.

(some units are more authentic in their learning, but for this unit I want to work on AP/DP testing skills and experimental analysis, which will focus on command terms and analysis of data from experiments conducted).

Learning Goals/Objectives	Learning Activities	Assessment Activities
<u>Building a Foundation:</u> Learners will learn that the evolution of multicellular organisms allowed cell specialization and cell replacement. Learners will explain that eukaryotes have a much more complex cell structure than prokaryotes. Learners will explore the structure of biological membranes makes them fluid and dynamic and that	Flipped-classroom reading for comprehension using the IB Biology Oxford eBook. Cell Survivor: Review of cell organelles and their structure/function. Learning stations of electron micrograph measurements, cell comparison, cell surface area to volume ratio. Cell Membrane animation Theory of Knowledge discussion understanding “Biology is the study	Formative quick feedback activities using Kahoot (during cell survivor), ClassCraft Boss Battles Formative assessment on cell membrane video Formative assessment on cell transport video. Formative assessment quiz over unit. Summatives: Osmosis experiment, unit test

membranes control the composition of cells by active and passive transport.	of life, yet life is an emergent property. Under what circumstances is a systems approach productive in biology and under what circumstances is a reductionist approach more appropriate? How do scientists decide between competing approaches?" Cell Transport Problems Cell Transport Experiment and Data Analysis	
<u>Applying Knowledge:</u> Learners will illustrate the relationship between structure and function of cell organelles Learners will identify electron micrograph organelles. Learners will describe and explain the origin of cells Learners will analyze and evaluate data from experiments that explore osmosis.	Discussion Sketches, modeling Osmosis Experiment	Formative assessment on video models, quiz over unit Summative on Experiment and unit test
<u>Integration:</u> Learners will justify the importance of each organelle in the cell. Learners will apply the scientific method to analyzing and evaluating their experiment Learners will consider theory of knowledge and the understanding the origin of cell.	Cell Survivor Labs/Experiments Class discussion	Formative assessment via quiz Summative assessment on analysis and evaluation of experiment

<u>Human Dimension</u> Learners will learn that a correlation to disease or common health related issues exist when cell organelles are not working properly.	Cell Survivor Class Discussion Cell Transport/Membrane lesson	Formative Quiz Formative videos on membrane and transport
<u>Learning How to Learn</u> Learners will use management tools to daily plan their personal learning experience.	Agenda book planning Feedback from peers	